

## REMARKS/ARGUMENTS

This Response is being submitted in response to the Office Action dated October 21, 2008. Claims 1, 4, 7-8, and 11-13 are currently amended. Claims 2-3, 5-6, and 9-10 are original. Claims 14-16 are new. Claims 1-13 were pending and now, with 14-16 added, claims 1-16 are pending in this application. Claims 1-13 stand rejected. Reconsideration and reexamination are respectfully requested.

### Rejections Under 35 U.S.C. § 103

Claims 1-13 stand rejected under 35 USC 103(a) as purportedly being unpatentable over Sheldon (R. Sheldon, "Catalytic reactions in ionic liquids", Chem. Commun., 2001, pp. 2399-2407, vol. 23, The Royal Society of Chemistry, United Kingdom; hereinafter "Sheldon").

Specifically, the Examiner has rejected claims 1-13, stating, inter alia, that it would have been obvious to exchange one ion for another in the ionic liquid based on the reaction conditions or desired reaction conditions. See Office Action of October 21, 2009, page 3. Applicants respectfully traverse these rejections for at least the reasons discussed below, and respectfully submit that Applicants' developments would indeed NOT be obvious to one skilled in the art for the following reasons.

"[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." In re Kahn, 441 F. 3d 977, 988 (Fed. Cir. 2006). The law of obviousness requires that there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. See, KSR International Co. v. Teleflex Inc., 550 U.S. 398, 82 USPQ2d 1385 (2007) (the KSR Court expressly retained the teaching, suggestion or motivation test) and see, e.g., MPEP 2143, inter alia; see also In re

Vaack, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) (concentrating upon what the prior art actually 'taught', 'expressed', 'conveyed', and/or 'spoke of').

Combining known prior art elements is not sufficient to render the claimed invention obvious if the results would not have been predictable to one of ordinary skill in the art. KSR International Co. v. Teleflex Inc., 550 U.S. 398, 82 USPQ2d 1385 (2007); and see, United States v. Adams, 383 U.S. 39,42-43, 51-52, 148 USPQ 479, 480, 483-84 (1966) (stating that "[d]espite the fact that each of the elements . . . was well known in the prior art, to combine them as did Adams required that a person reasonably skilled in the prior art must ignore the teaching away of the prior art . . ."). "When the prior art teaches away from combining certain known elements, discovery of successful means of combining them is more likely to be nonobvious." KSR v. Teleflex, supra, at 1395.

As noted by the examiner, the acylation reactions taught by Sheldon do not employ the same anion, i.e. trifluoromethanesulfonate, as employed in the instant process. When defining ionic liquids, Sheldon does teach that trifluoromethanesulfonate is also an anion that may be employed with a dialkylimidazolium cation (p. 2399, second column, Fig.1, Table 1, and p. 2400, first column). Particularly, Sheldon mentions 1-ethyl-3-methylimidazolium trifluoromethanesulfonate as part of a list (p. 2399, second column, Table 1, and p. 2400, first column), but no specific, suggestive or motivating mention is made of their use in Friedel-Craft acylation reactions.

As also noted by the examiner, Sheldon generally teaches monophasic systems wherein the ionic liquid acts as both the solvent and the catalyst. Particularly, Sheldon refers to dialkylimidazolium chloroaluminates as Friedel-Crafts catalysts (p. 2400, second column; emphasis added):

One can envisage various scenarios for catalysis in and/or by ionic liquids:

- Monophasic systems in which the catalyst and substrate are dissolved in the ionic liquid.
- Monophasic systems in which the ionic liquid acts as both the solvent and the catalyst, e.g. dialkylimidazolium chloroaluminates as Friedel-Crafts catalysis (see later).
- Biphasic systems in which the catalyst resides in the ionic liquid and the substrate/product in the second phase or *vice versa*.

In the section of Sheldon entitled "Lewis and Brønsted acid catalysis in ionic liquids", where Friedel-Craft reactions are described, more details are given on ionic liquids containing chloroaluminate anions, which are said to be strong Lewis acids and, if protons are present, also superacidic. Sheldon mentions that ionic liquids can function as both a catalyst and a solvent for acid catalysed processes (p. 2404, second column; emphasis added).

### **Lewis and Brønsted acid catalysis in ionic liquids**

Ionic liquids containing chloroaluminate ( $\text{AlCl}_4^-$ ,  $\text{Al}_2\text{Cl}_7^-$ ) anions are strong Lewis acids and if protons are present they are superacidic (see earlier). Coupled with the fact that they are relatively easy to handle this makes these materials attractive non-volatile alternatives for standard Lewis acid catalysts, such as  $\text{AlCl}_3$ , and hazardous Brønsted acids such as HF. The ionic liquid can function as both a catalyst and a solvent for acid catalysed processes. Since Lewis and Brønsted acid-mediated

Additionally, Sheldon mentions that some of the first reactions to be studied in ionic liquids were Friedel-Crafts alkylations and acylations. Nevertheless, subsequently and importantly, it is also stated that not all ionic liquids are active as Friedel-Crafts catalysts (p. 2404, second column; emphasis added), where "emim" means ethylimidazolium:

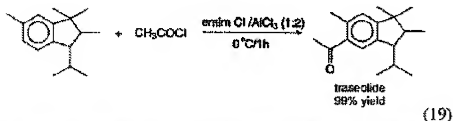
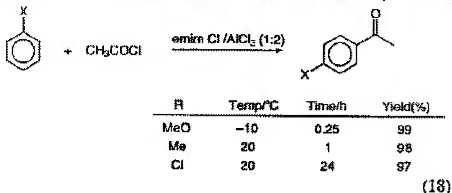
rate enhancements in ionic liquids. Indeed, some of the first reactions to be studied in ionic liquids were Friedel-Crafts alkylations and acylations. Wilkes and coworkers<sup>69</sup> showed that ionic liquids derived from the reaction of emimCl with  $AlCl_3$  exhibit a wide range of Lewis acidity depending on the molar ratio of reactants. A 1:1 mixture affords the tetrachloroaluminate,  $emimAlCl_4$ , which is referred to as being neutral and is not active as a Friedel-Crafts catalyst. In contrast, the 2:1 adduct,  $emimAl_2Cl_7$ , is strongly acidic and was shown to be very active in Friedel-Crafts alkylations and acylations.<sup>69</sup> For

Sheldon fails to present any motivation to use ionic liquids containing trifluorosulfonate anion ( $CF_3SO_3^-$ ): In the section related to "Lewis and Brønsted acid catalysis in ionic liquids," Sheldon describes two kinds of Friedel-Crafts reactions, namely acylation reactions and alkylation reactions. Concerning Friedel-Crafts acylation reactions, ionic liquids containing chloroaluminate anions are reported to be useful catalysts/solvents, but several drawbacks associated with the mentioned anions are noted, namely, on one hand the high reactivity towards water of the chloroaluminate anions (p. 2399, second column and 2400, first column; emphasis added):

Room temperature ionic liquids are not new. Ethylammonium nitrate, which is liquid at room temperature (but usually contains 200–600 ppm water) was first described in 1914.<sup>9</sup> In the late 1940s, *N*-alkylpyridinium chloroaluminates were studied as electrolytes for electroplating aluminium. These systems were reanimated by the groups of Hussey,<sup>10</sup> Osteryoung<sup>11</sup> and Wilkes<sup>12</sup> in the late 1970s. The first examples of ionic liquids based on dialkylimidazolium cations were reported in the early 1980s by Wilkes and coworkers.<sup>12</sup> They contained chloroaluminate anions ( $AlCl_4^-$  or  $Al_2Cl_7^-$ ) and proved to be useful catalysts/solvents for Friedel-Crafts acylations.<sup>13</sup> However, a serious obstacle for widespread use of these ionic liquids is the high reactivity of the chloroaluminate anion towards water.

and, secondly, the difficulty of recovery of the final ketone product due to the strong complex formed with the chloroaluminate ionic liquid (p. 2404, second column; emphasis added):

Seddon and coworkers<sup>72</sup> studied the Friedel–Crafts acylation of toluene, chlorobenzene and anisole with acetyl chloride in emimAl<sub>2</sub>Cl<sub>7</sub>, and obtained excellent regioselectivities to the *para* isomer (Reaction 18). Similarly, the fragrance chemical, traseolide, was obtained in 99% yield as a single isomer (Reaction 19). It should be noted, however, that the question of



product recovery from the reaction medium still needs to be addressed in these systems. As in conventional AlCl<sub>3</sub>-promoted acylations the ketone product forms a strong complex with the chloroaluminate ionic liquid.

There is also an example of an ionic liquid used in a Friedel-Craft alkylation reaction, but this is of no interest to assess the inventive step of the instant claims, related to a Friedel-Craft acylation.

Thus, there is no teaching, suggestion or motivation in Sheldon to use ionic liquids containing trifluoromethanesulfonate anions in Friedel-Craft acylation reactions.

Consequently, there is no expectation of success therefrom for the process defined by the instant claims.

It should be noted that chemistry, being a generally unpredictable art, doesn't provide for generalized expectations of success in or from one class of compounds to another. See In re Papesch, 315 F.2d 381, 137 USPQ 43 (CCPA 1963). Here, this indicates that any success Sheldon may have had with ionic liquids containing chloroaluminate anions does not, without more, teach or suggest any expectation of success with a different class of compounds, e.g. ionic liquids containing trifluoromethanesulfonate anions. Note, this is the general basis for the need for data in chemistry cases, as it is typically not predictable that a particular success is or may have been achieved, generally, when any changes are made from the original chemistry or chemical process.

Still furthermore, the currently claimed formulation yields unexpectedly improved properties or properties not present in the prior art, particularly the present invention allows to carry out Friedel-Crafts acylations with good yields and high selectivity in the *para* position of the Friedel-Crafts aromatic substrate (Applicants' specification, page 2, para. [0026]), as can be seen from Examples 1 to 4, where selectivity *ortho/para* is 0/100. Such increase in properties is not predictable from Sheldon, nor the effectiveness, thus bolstering the non-obviousness of the direction taken by the inventors here. At the same time, the problems mentioned above, associated with the use of ionic liquids containing chloroaluminate anions disclosed in Sheldon (see above) are avoided, also not suggested, taught or motivated by Sheldon.

Thus, Applicants have demonstrated that the particular anion of the ionic liquid, trifluoromethanesulfonate, can provide desirable, yet unpredictable and thus new and unexpected results, generally by showing that the claimed process achieved different purposes and effects over that which was available in the prior art. These results are not predictable, nor is the use of the specific ionic liquid; no teaching, suggestion or motivation being found therefor.

Claims 2-16 are all directly or indirectly dependent on claim 1 and include all its features. Accordingly, Applicants incorporate their above arguments, and submit that Applicants' claims 1-16 are believed to be allowable at least for the same reasons set forth above for claim 1. Reconsideration and withdrawal of these rejections are thus also respectfully requested.

## CONCLUSION

Applicants note that all rejections are obviated or traversed hereby and respectfully request that they thus be withdrawn. A timely Notice of Allowance is thus requested to be issued in this case. Applicants believe that, apart from the fee for the extension of time to reply, no fees or petitions are due with this filing. However, should any such fees or petitions be required, please consider this a request therefore and authorization to charge Deposit Account No. 02-2093 as necessary.

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Respectfully submitted,

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